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DETERMINATION OF CARDIAC OUTPUT BY TRANSESOPHAGEAL CONTINUOUS WAVE DOPPLER

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A new prototype transesophageal transducer with continuous-wave Doppler capabilities was utilized to measure intraoperative cardiac output (CO) in 13 consecutive patients, aged 58 ± 17 years, undergoing coronary artery bypass surgery. The main pulmonary artery (PA) was imaged with the transesophageal transducer and a steerable continuous wave Doppler cursor was aligned parallel to flow above the pulmonic valve. The PA cross-sectional area (A) was calculated from its diameter (D) above the pulmonic valve ($A = 1/4\pi D^2$). The PA areas were multiplied by the flow velocity integrals (FVI) of the continuous wave Doppler spectra and then multiplied by the heart rate (HR) to yield CO. (A X FVI X HR = CO). The data for the group are as follows: PA area was 3.1 ± 0.6 cm^2, FVI was 23.8 ± 0.4 cm, HR was 64 ± 10/min, and calculated CO was 4.7 ± 0.3 L/min. The Doppler derived CO were correlated with simultaneous measurements of CO by thermodilution technique (4.4 ± 0.3 L/min). Linear regression analysis revealed a close correlation with $r = 0.91$, $p<0.001$, $y = 0.94x + 0.2$. Transesophageal continuous wave Doppler is a promising new technique that may be used for measurement of CO.

TRANSVASCULAR INTRACARDIAC IMAGING APPLICATIONS OF A MINIATURIZED PHASED ARRAY ULTRASONIC ENDOSCOPE AFTER TRANSCATHETER ATRIAL SEPTAL DEFECT (ASD) CLOSURE: EXPERIENCE IN PIGLETS.

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We tested a new miniaturized 6.3 mm, 17-element, 5MHz phased array probe mounted on a 4mm endoscope to assess its capabilities for performing intracardiac imaging from a transvascular approach in 4 piglets weighing 8-11Kg. Experimentally created ASD's had been closed with a "buttoned" ASD closure device consisting of an occluder in the LA, a counteroccluder in the RA and a buttoning mechanism. Following Ketamine anesthesia (10-20 mg/Kg IV) with animals spontaneously breathing, the probe was easily introduced through a cut-down incision into the external jugular vein and advanced to the RA. Minimal superior and inferior angulation and rotation visualized both atria, atrioventricular valves, ventricles and great vessels in detail. Color Doppler flows were recorded from the vena cavae, pulmonary veins, through both AV valves and great vessels. High resolution imaging of the atrial septum defined with anatomical accuracy, later verified by autopsy, the exact placement of both the occluder and counteroccluder on the left and right sides of the ASD and absence of any residual shunting. Intravascular applications of this device may provide an alternative to transesophageal echocardiography, particularly for guiding interventional procedures and placement of transcatheter closure devices. Further miniaturization and increase in frequency to 7.5-10MHg should permit eventual introduction through a femoral venous approach which would require less sedation than transesophageal echo for children.

NEW REAL-TIME TWO DIMENSIONAL-ASSISTED MEASUREMENT OF MYOCARDIAL REGIONAL ACOUSTIC PROPERTIES IN THE CORONARY CARE UNIT: ON-LINE CALCULATION AND DISPLAY OF BACKSCATTER DATA

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We have previously shown that measurements of myocardial cyclic variation of integrated backscatter in patients with acute myocardial infarction permits recognition of stunned myocardium. However the previous measurements required M-Mode guided acquisition of backscatter data limiting the number of data points from the tissue of interest. To define the applicability of two-dimensional acquisition of backscatter data from discrete myocardial segments as opposed to "ice pick" views we performed serial two-dimensional backscatter studies (n = 28) in 10 patients with acute myocardial ischemia within 24 hours of admission and at 2 other intervals before discharge. In the parasternal long axis view detection of septal (base or mid) backscatter was possible in 86% and for posterobasal wall was 80%. These yields are higher than those with the M-Mode method used in the past. Wall motion was normal in 35 segments and hypo-or akinetic in 28. Backscatter data could not be obtained from 21 segments (25%). Cyclic variation was significantly greater in normal compared with abnormal segments (mean 2.9 ± 1.0 vs 1.9 ± 0.6 dB, $p < 0.0001$). Thus, multiple regional myocardial measurements of integrated backscatter are now possible with two-dimensional imaging, and should improve the quantitative assessment of ischemic myocardium.

3-DIMENSIONAL RECONSTRUCTION OF CORONARY AND PERIPHERAL VESSELS FROM 2-D IVUS IMAGES: DETERMINATION OF OPTIMAL IMAGE ACQUISITION RATE DURING TIMED PULLBACK

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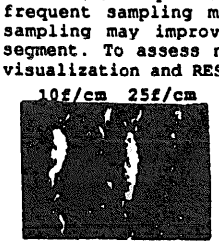
Three-dimensional reconstruction (3DR) of two-dimensional (2D) image acquired during intravascular ultrasound (IVUS) exam may supplement information obtained by angiography and IVUS alone, by providing a more detailed view of luminal borders in a longitudinal format familiar to angiographers. 3DR is performed using a systematic, timed IVUS catheter pullback (PB) along the vessel length (L) of interest. Variables affecting 3D image resolution (RES) and length of reconstructed segment include PB speed (2-5 sec/cm) and frame (f) acquisition rate (max 7.5 f/sec). Less frequent sampling may compromise RES; more frequent sampling may improve RES, but restrict L of imaged segment. To assess number f/cm required to optimize L visualization and RES of composite 3D image, we



systematically adjusted f acquisition rate on 18 PB recordings obtained during interventional procedures from 5-25 f/cm during 3DR. Resulting was inadequate at <15 f/cm particularly in vessels with irregular border/lumen interface. PB at >20 f/cm restricted L of vessel segment to less than optimal for comparison of diseased versus less diseased sites. Acquisition of 20 f/cm provided optimal compromise between RES and L of 3DR. These findings indicate need for expansion of memory capability to provide unlimited L without compromising RES.